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**AUTOMATIC SYSTEM FOR MONITORING AND MANAGING THE ADMITTANCE
TO PARKING PLACES**

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TECHNICAL FIELD

This invention concerns an integrated automatic system for remote monitoring and management of vehicle access and parking in urban areas on a selective basis.

10 More specifically, this invention refers to an integrated automatic system for the control and management of spaces designed for the parking of vehicles in general in urban areas.

15 According to another aspect, this invention refers to a procedure for the management of this integrated automatic system.

This invention can be applied in the industrial sector for the production of automatisms and transducers in general.

20 **BACKGROUND ART**

It is known that in countries with a high level of technology, the growing number of motor vehicles has made traffic problems extremely important, requiring local administrations to impose limits on the circulation and parking of vehicles in urban areas.

These problems are particularly evident in town centres and in areas with a high density of traffic, making it necessary to introduce structured systems to regulate access and to control parking, generally based on the allocation of 30 limited traffic zones and/or on tariff and selective authorisation mechanisms (long-term access and parking

permits for residents, limited permits for registered users, "time" tariffs for occasional users, etc.).

Receiver-transmitter devices for the automatic detection of the presence or transit of vehicles have 5 already been proposed and consolidated technologies already exist on the market, albeit presenting some problems.

The power of the signals must, in fact, be very low to prevent the system from being too complex, to limit the costs and to restrict electromagnetic pollution to 10 negligible levels, taking into account the considerable presence of the devices in highly frequented areas.

A further problem is represented by the fact that the devices currently used do not guarantee a high degree of efficiency, presenting a considerable number of errors and 15 cases of malfunctioning.

The detection and management means of these systems also require a considerable use of human resources, particularly for the material operations of monitoring the areas in which access or parking are managed selectively.

20 Another drawback is represented by the fact that the efficacy of the means used is encumbered by limits and interruptions that are difficult to avoid.

DESCRIPTION OF THE INVENTION

25 This invention proposes to provide an integrated automatic system for the remote monitoring and management of vehicle access and parking in urban areas on a selective basis, which is able to eliminate or significantly reduce the problems described above.

30 This invention also proposes to provide an automatic system which can guarantee the possibility of identifying

stationary or slowly moving vehicles in specific monitoring points considered useful by the management for the functionality of the system.

5 A further aim of this invention is to provide a system based on the exchange of relatively low-power signals to restrict the electromagnetic power emitted.

This is achieved by means of a system with the features described in the main claim.

10 The dependent claims described advantageous embodiments of the invention.

According to another aspect this invention also proposes to provide a procedure for the management of this integrated automatic system.

15 This is achieved by means of a procedure with the features described in claim 7.

The integrated automatic system according to this invention comprises:

- a mobile recognition device, in which a user code is memorised, which can be positioned inside a vehicle;
- 20 - a detection sensor installed in a respective parking space;
- a network for the connection of these detection sensors to a fixed data collection station;
- a possible second network for the connection of several fixed stations for the collection of data on respective parking space areas;
- 25 - a control centre for decoding and reprocessing of the data.

According to the invention the identification code of 30 the user is memorised in a device appropriately positioned in the respective vehicle authorised to use the system.

This code allows the management to automatically identify the data relative to the vehicle and the user, and makes it possible to activate a series of services, including the automatic payment of the parking fee against 5 prepaid amounts or by means of authorisation to charge the fee to a bank account.

The mobile recognition device is a miniaturised instrument which can be positioned inside a vehicle and is equipped with a memory containing the user identification 10 code.

The code is transmitted automatically by radio-frequency to the detection sensors, located at the accesses or in the parking spaces in the protected areas.

According to one embodiment of the invention, the 15 procedure for the management of this integrated automatic system foresees:

- the detection of the presence of a vehicle in a specific respective parking space;
- the recognition of the vehicle as authorised or not 20 authorised to use the space;
- the emission of a visual and/or acoustic signal demonstrating the occupation of the space;
- the detection of the parking time of the vehicle in the space;
- 25 - the transmission of the occupation of the space and of the data relative to the recognised or not recognised vehicle to a general area controller device;
- the transmission of the data collected by the area controller device or by several area controller devices 30 to a general central unit designed to store the data regarding recognised vehicles and to immediately report

- any unauthorised parking by vehicles without authorisation;
- the calculation, by the central unit, of the fee in relation to the parking time;
- 5 - if required, transmission of the data relative to the fee charged to the bank authorised for payment with the consent of the user.

The integrated automatic system, for the remote monitoring and management of vehicle access and parking in 10 urban areas on a selective basis, allows rationalised and advantageous management of the problems regarding access and parking in urban areas.

This system and this procedure also make it possible to achieve high levels of reliability for the user with 15 reference to the security of the data contained in the memory of a miniaturised circuit.

The integrated automatic system ensures a significant reduction of the pollution emitted by vehicles in densely populated areas due to a drastic reduction in the time spent 20 by the users in search of a parking space.

The transmission of data at low frequencies makes it possible to restrict the levels of electromagnetic pollution well below the threshold of caution.

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DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will become evident on reading the following description of one embodiment of the invention, given as a non-binding example, with the help of the enclosed drawings, in which:

- 30 - figure 1 represents a prospective view, slightly from above, of a column used to construct the system

according to the invention; and
- figure 2 is a simplified diagram of the devices making up the system according to the invention.

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DESCRIPTION OF AN EMBODIMENT

In figure 1, the reference number 10 indicates in general a fixed column, in the case in question a column 10 designed to detect the presence of a vehicle in a parking space adjacent to it.

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In the case illustrated, the column 10 has a cylindrical shape and is equipped with at least one presence sensor 11 designed to detect the parking of a vehicle.

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According to other embodiments, the column 10 may have a different shape and be equipped with a number of presence sensors 11, or a multitasking sensor.

In the embodiment illustrated in the figures, the presence sensor 11 is positioned on the side of the column 10. It may, however, be placed in any position.

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The side of the column 10 may also be equipped with luminous indicators 12 confirming the detection of an authorised or non-authorised vehicle.

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The colour of these indicators 12 may be green in the first case and red in the second in order to attract the attention of any supervision personnel present in the area or to indicate the possibility or impossibility of parking.

The upper part of the column 10 may present a buzzer 13 which can be activated if an unauthorised vehicle is parked.

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According to this embodiment, the top 14 of the column 10 is equipped with an interface 15, for communication with the user, and a slot 16 designed to issue receipts or printed messages of use to authorised users.

DESCRIPTION OF THE SYSTEM

With reference to figure 2, it can be seen that the integrated automatic system for remote monitoring and 5 management of vehicle access and parking in urban areas on a selective basis comprises:

- a mobile recognition device 17, containing a user code, which can be positioned inside a vehicle 18;
- a detection sensor 11 installed next to a respective 10 parking space 19;
- a network connecting the detection sensors 11 to a fixed data collection station 20;
- a second network connecting several fixed stations 20 designed to collect the data from the respective parking 15 space areas;
- a control centre 21, connected to the second network, for decoding and reprocessing the data.

The presence sensors 11 allow both reception of the user code, transmitted by radio-frequency by the 20 identification device 17 when the vehicle is parked, and the detection (not backed by frequency signals) of the presence of vehicles 17 or motorcycles unequipped with the aforesaid device and parked in the parking areas 19 controlled by the sensors.

25 In the first case, the signal sent to the fixed stations 20 for data transmission will be the user code.

In the second case, a signal is emitted warning the control centre 21 that a vehicle 17 without the 30 identification device is parked (information which can trigger on-the-spot checks).

The need to detect the presence of any vehicle 18

parked in a specific parking area, even if it is not equipped with the recognition device, foresees the use of sensors 11 equipped with two separate electronic circuits: one dedicated to the reception-transmission of radio-frequency signals, the other designed to detect the presence of a vehicle in the specific space, for example a detector which is sensitive to the changes in magnetic induction within a determined space (a parameter which makes it possible to establish the presence or absence of a vehicle 10 18).

The functioning principle of the interconnected fixed stations 20 consists of the acquisition of data (user code or generic parking signal) from the detection sensors 11 and the transmission of the data to the central control unit 21.

15 The fixed stations 20 receive signals from the column 10 positioned at the start of a certain row of parking spaces or inside a car park.

These columns 10 are powered by connection to a normal electricity power line.

20 In order to carry out the required functions, the stations 20 and the columns 10 are equipped with specific hardware and firmware.

25 The control centre 21 acquires all the data from the from the fixed stations 20 located in the peripheral areas and reprocesses them by means of the IT system and is equipped with appropriate printing and display options, both on the spot and in remote units.

The IT system not only organises the data by means of specific databases and software for area management, but 30 also carries out a series of complex processes in order to automatically inform the operators of any infringements

committed by the users.

Knowing exactly where and by whom the infringement is committed will ensure the subsequent notification of the fine and will, if necessary, trigger the intervention of the traffic police.

The identification device 17 consists of a miniaturised transmitter which can be positioned inside a vehicle 18 and equipped with a memory containing the user identification code.

Alternatively, according to a preferred embodiment, the identification device 17 consists of the mobile telephone of the user, who by means of appropriate transmissions, for example SMS messages or a GPRS connection, communicates his/her identity to a receiving device positioned in the column.

The device 17 ensures minimal electromagnetic pollution, limited energy consumption and a high degree of autonomy.

Advantageously, detection sensors 11 present a minimum radius of action of around 5 metres, an amplifier noise temperature of less than 290°K, an amplifier gain between 40 and 50 dB and a transmission frequency between 20 and 500 kHz.

The columns 10 and the fixed data transmission stations 20 can have a maximum emission power of 1 mW, a transmission time of less than 2 min/h and a transmission band between 10 Hz and 50 KHz. They can also be equipped with a microprocessor functioning at a frequency between 75 and 100 MHz, with a RAM of up to 10 Mbyte and a fixed EEPROM of up to 500 Kbyte while their interface with the control centre 21 can be the bidirectional serial type as they are equipped

with an integrated modem for data transmission.

The data collection centre 21 can receive the data by cable and by radio-frequency and can be equipped with means of intermittent transmission (polling), restricting 5 irradiated power to a minimum.

The antenna gain is advantageously between 3 and 6 dB, while the preamplifier gain could fluctuate between 70 and 80 dB and the signal/noise ratio between 50 and 60 dB.

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DESCRIPTION OF THE PROCEDURE

The procedure for the management of the integrated automatic system, for the remote monitoring and management of vehicle access and parking in urban areas on a selective basis, foresees:

- 15 - the detection of the presence of a vehicle 18 in a specific respective parking space 19;
- the recognition of the vehicle 18 as authorised or not authorised to use the space 19;
- the emission of a visual and/or acoustic signal confirming occupation of the space 19;
- 20 - the detection of the time in which the vehicle 18 is parked in the parking space 19;
- the transmission of the occupation of the parking space 19 and of the data relative to the recognised or not recognised vehicle 18 to a general area control device 25 20;
- the transmission of the data collected by several area control devices 20 to a central unit 21 designed to store the data relative to recognised vehicles 18 and to 30 immediately report any unauthorised occupation by vehicles 18 without authorisation;

- the calculation, by the central unit 21, of the fee in relation to the parking time;
- the transmission of the data regarding the fee to a bank authorised for payment with the consent of the user.

5 The invention is described above with reference to a particularly advantageous embodiment.

It is nevertheless clear that the invention is susceptible to numerous variations, within the framework of technical equivalents.

10 By way of example, one embodiment is foreseen which can be used in particular in the case of ground level car parks.

In this case it is not possible to arrange an area of rows of vehicles as in the cases described above, and the vehicles are not parked in an orderly fashion, and may even 15 face different directions within the same slot; the slots are very close to each other.

In order to set up the system according to this invention the use of a modified sensor installed on the vehicle is foreseen, having a pair of LCD displays (one 20 internal and one external), a pair of pushbuttons, for parking start and end respectively, an active RFID tag, a buzzer and a two-colour LED. The column, on the other hand, is equipped with a vehicle sensor of the type described above and a bidirectional controller of the RFID tag.

25 Let's look at a typical case, in which the user intends to park in a ground level car park. The vehicle sensor (VS) sends a request for identification and the tag on the column (AT) replies.

The user then presses the "parking start" pushbutton, 30 and the AT sends the ID and the parking start information to the VS.

The VS sends an acceptance signal to the AT (green LED for 2 seconds and buzzer sound) and sends the data to the central system. At the end of the parking time the user presses the "parking end" pushbutton, the AT sends the 5 information to the VS which replies in acceptance (green LED for 2 seconds and buzzer sound) and to the central system.

This and other variations are included within the framework described by the following claims.